

## PATENT ABSTRACTS OF JAPAN

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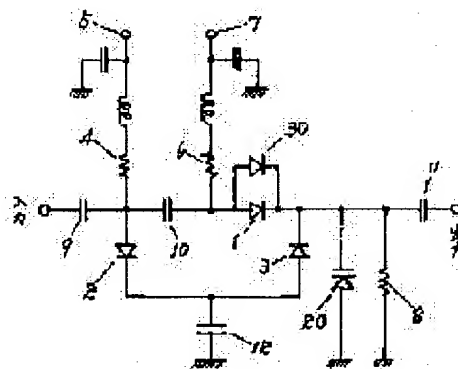
## (54) GAIN CONTROL CIRCUIT

## (57)Abstract:

PURPOSE: To obtain the gain control circuit whose input/output impedance is constant and whose frequency amplitude characteristic is flat within a prescribed frequency band.

CONSTITUTION: In the gain control circuit in which one or over of variable resistive elements 1-3 whose resistance changes with an applied voltage are connected in a form of  $\pi$ , a varactor element 20 is connected in series or parallel with the variable resistive elements to change the capacitance of the varactor element 20 with a voltage controlling the resistance of the variable resistive elements. Thus, the input/output impedance is compensated and the frequency amplitude characteristic within a frequency band is made flat.

Furthermore, at least the parallel connection of two variable resistive elements 1, 30 is adopted for the variable resistive elements connecting in series with the strip line from an input terminal to an output terminal to reduce the insertion loss.



## LEGAL STATUS

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2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the gain control circuit for obtaining the stable receiving level in the receive section which receives amplitude information, such as an image and voice.

[0002]

[Description of the Prior Art] In the frequency division multiplex transmission system by frequency modulation, bandwidth is wide because of multi-channel transmission including a satellite broadcast-band region, and in order to obtain the receiving level stabilized in the high region in the receive section, the gain control circuit of a broadband mold has come to be required.

[0003] As shown in drawing 4, on the stripline which goes to an outgoing end from an input edge, the conventional gain control circuit is equipped with the adjustable attenuation circuit of pi form which consists of a variable resistive element 1 arranged to the serial, and the variable resistive element 2 and variable resistive element 3 which have been arranged between a stripline and touch-down, through resistance 4, impresses a fixed electrical potential difference from a terminal 5, and is impressing control voltage 7 from the terminal 7 through resistance 6. In addition, 8 is resistance for bias, 9, 10, and 11 are the capacitors for DC blocking, and 12 is a capacitor for grounding in alternating current.

[0004]

[Problem(s) to be Solved by the Invention] However, in such a gain control circuit, as the parasitism reactance which a variable resistive element has influenced greatly and it was shown in the characteristic curve sheet of drawing 5, the magnitude of attenuation in a high region decreased, and there was a problem that a level difference arose in the dynamic range in a predetermined frequency band, so that it became the high region of a frequency band, when gain control in a broadband was performed.

[0005] While this invention was considered in order to solve such a trouble, and its I/O impedance in a predetermined frequency band is fixed, the frequency amplitude characteristic is flat and the purpose of obtaining the outstanding gain control circuit which is a low insertion loss is carried out.

[0006]

[Means for Solving the Problem] In order to attain this purpose, the gain control circuit of this invention carries out flattening of the frequency amplitude characteristic in a frequency band while fixing an I/O impedance by changing the capacity of a variable-capacity component with the electrical potential difference which connects a variable-capacity component to a serial or juxtaposition at a variable resistive element, and controls the resistance of a variable resistive element by applied voltage in the gain control circuit which has one or more variable resistive elements from which that resistance changes. Moreover, \*\* which connected at least two variable resistive elements to the variable resistive element linked to a serial at juxtaposition is used on the stripline which goes to an outgoing end from an input edge, and an insertion loss is reduced.

[0007]

[Function] While fixing an I/O impedance by changing the capacity of the variable-capacity component linked to a serial or juxtaposition to a variable resistive element, flattening of the frequency amplitude

characteristic in a frequency band can be carried out.

[0008]

[Example] (The 1st example) As shown in drawing 1, it has the adjustable attenuation circuit of pi form which consists of a variable resistive element 1 arranged to the serial, and the variable resistive element 2 and variable resistive element 3 which have been arranged between a stripline and touch-down on the stripline which goes to an outgoing end from an input edge, and the variable-capacity component 20 is further connected between a stripline and touch-down. And a fixed electrical potential difference is impressed through resistance 4 from a terminal 5, and control voltage is impressed through resistance 6 from a terminal 7.

[0009] As three variable resistive elements 1-3, the PIN diode from which internal resistance changes with forward current is used, and variable capacitance diode is used for the variable-capacity component 20.

[0010] In addition, 8 is resistance for bias, 9, 10, and 11 are the capacitors for DC blocking, 12 is a capacitor for grounding in alternating current, and resistance 4, 6, and 8 is high resistance as an I/O impedance is not influenced.

[0011] Next, actuation of the gain control circuit of the adjustable attenuation mold constituted in this way is explained.

[0012] By passing forward current to each variable resistive elements 1-3 as it is also at the difference of the fixed electrical potential difference 5 impressed to the terminal 5, and the control voltage impressed to the terminal 7, and giving predetermined resistance, although attenuation predetermined in a predetermined frequency band should be obtained by the theory top, since a parasitism reactance surely exists in each variable resistive elements 1-3 and pure resistance does not become, an I/O impedance changes.

[0013] Then, as the variable-capacity component 20 is connected to a variable resistive element 3 and juxtaposition, and the capacity of the variable-capacity component 20 is changed, and an I/O impedance is fixed in a predetermined frequency band and it is shown in the characteristic curve sheet of drawing 3 with the control voltage impressed from a terminal 7, the frequency amplitude characteristic is made flat.

[0014] In addition, the capacity value of variable capacitance diode enlarges control voltage at the time of low attenuation, sets capacity value to several pF, makes control voltage small at the time of high attenuation, and capacity value is made to be set to dozens of pF.

[0015] (The 2nd example) As shown in drawing 2, a variable resistive element 30 is connected to a variable resistive element 1 and juxtaposition. Although the PIN diode is used as a variable resistive element 1, since few resistance exists and an insertion loss is produced even if it passes the forward current of the maximum rating, by connecting a variable resistive element 30 to juxtaposition, resistance is made into one half and an insertion loss is reduced.

[0016] In addition, in the above example, although constituted from an adjustable attenuation circuit of pi form, the gain control circuit of this invention is applicable also to the adjustable attenuation circuit of T form, or the attenuation circuit of immobilization.

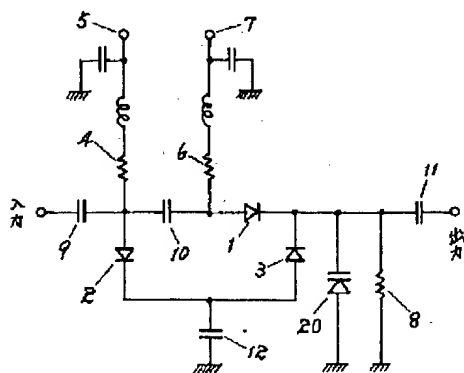
[0017]

[Effect of the Invention] While compensating and fixed-izing an I/O impedance by connecting a variable-capacity component to a serial or juxtaposition at a variable resistive element in the gain control circuit which has the variable resistive element from which the resistance changes with applied voltage so that clearly from the explanation based on the above example, flattening of the frequency amplitude characteristic in a frequency band can be carried out.

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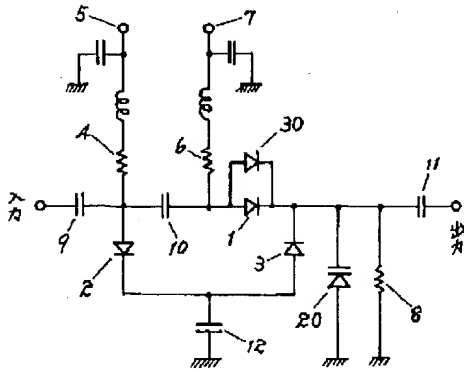
Drawing selection drawing 1



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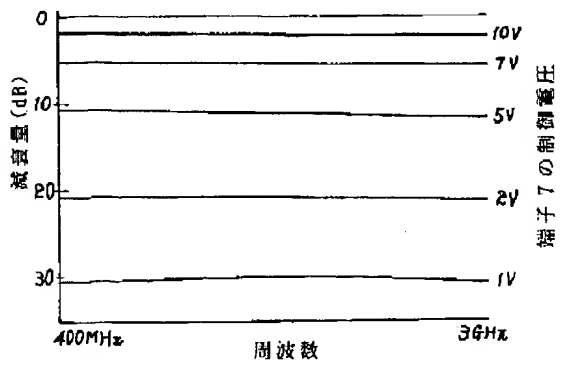
Drawing selection drawing 2



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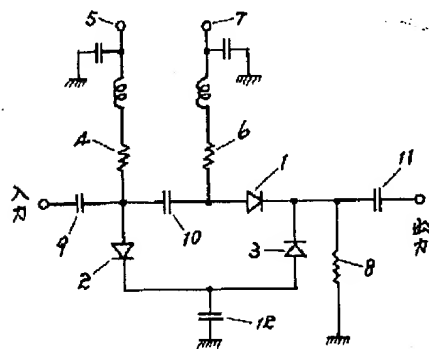
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Drawing selection drawing 3



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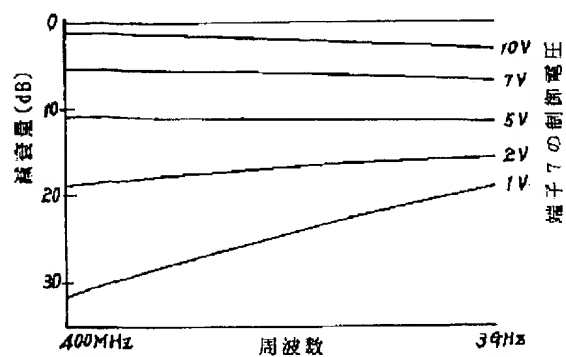
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Drawing selection drawing 4

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Drawing selection drawing 5

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